

Optimisation of an existing yeast management system by integrating new scientific results



Pongsawadi Phanomai, Chumpon Phiancharoen, Fritz Briem, Isara Khaola-iead, Markus Jungblut, Boonrawd Brewery, Bangkok, Thailand

Introduction:

A critical aspect in breweries which intend to increase production volume with a given equipment is the optimisation of the physiological properties of the yeast. In most cases an increase in gravity increases the yeast stress in a way that the original quality of the beer can no longer be maintained. On the other hand any reduction of production time succeeds or fails with the quality of the fermentation organism. This paper should demonstrate how to optimize an existing yeast management system (including yeast propagation and revitalisation) where an increase in gravity and a reduction of occupation time of the fermenters has been the target. It has quickly been realized that the bottle-neck of production is the quantity and quality of the yeast used for pitching.

Results:

Topping up fermenters:

A major issue in reducing the occupation time of the fermenters has been the reduction of the VDK concentration before deep cooling. Filling the fermenters within 12 hours reduced the maximum VDK concentration and accelerated VDK reduction rate as you can see in diagram 1.

Adjunct material:

With an adjunct ration of 40 % we found out that high-maltose syrup (HMS) shows benefits concerning yeast viability versus fructose syrup. An increase in gravity reduced the viability of the cropped yeast significantly (see diagram 2).

Nutrient addition:

Monitoring the nutrient composition of yeast wort and beer indicated that there might be a deficit of nutrients especially if malt is substituted by sugar based adjuncts. Table 1 gives an overview of selected minerals.

	yeast	wort	beer
Ca [ppm]	44,0	48	46
Cu [ppm]	0,6	0,2	>0,2
K [ppm]	1680,0	470	360
Mg [ppm]	148,0	97	93
Mn [ppm]	0,45	0,14	0,11
Na [ppm]	201,0	103	78
P [ppm]	1012,0	768	194
Zn [ppm]	31	0,13	0

Table 1

Diagram 3 shows how the Zn-concentration in the yeast is dropping from generation to generation if no or too low concentrations of nutrient is added to the wort or to the yeast during vitalisation.

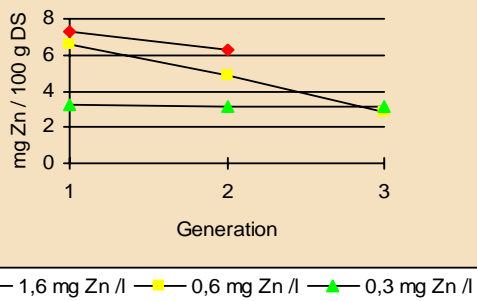


Diagram 3

Summary:

We were able to show that there are different technological approaches to optimize yeast management with respect to reducing production time during fermentation. It is basically the volume and quality of cropped yeast used for re-pitching which limits further optimization in the cold part of the brewery. "Refueling" and "destressing" the yeast before pitching is critical and should be the main focus of the yeast management system.

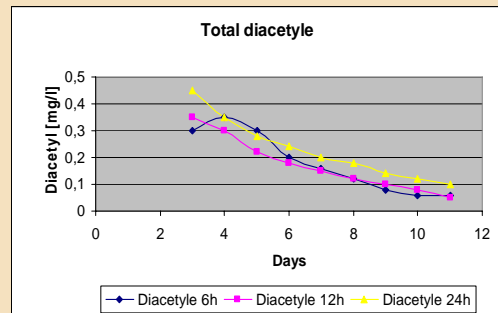


Diagram 1

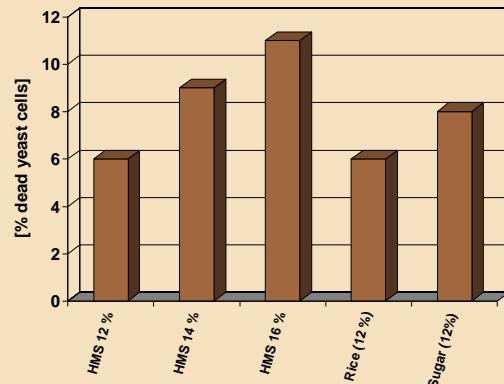


Diagram 2

A revitalisation after cropping the yeast in a separate tank with circulation and aeration after the addition of nutrient enriched wort increases the vitality significantly. Table 2 shows typical analytical data of a slurry from a vitalization unit compared to a fermentation and propagation vessel.

		Fermentation	Vitalisation	Propagation	Wort
OG	WW%	12,07	12,07	12,07	12,07
Extract _{real}	WW%	3,88	5,26	2,28	-
Alc.	WW%	4,27	2,98	0,71	-
Atten.	%	84	65	47	85
pH		4,15	4,92	4,01	5,31
FAN	ppm	53	108	21	208
Replication	Cells/ml	20 - 60	700 - 700	8 - 140	0

Table 2